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ABSTRACT

Data from the Scholastic Aptitude Test (SAT) and achievement tests and from the High School and Beyond Survey were examined to explore: (1) differences among states in the amount of coursework taken by high school students; (2) differences across states in SAT achievement test scores; (3) the relationship between course taking and achievement; and (4) implications for curriculum. High School and Beyond data were available from New York, California, Pennsylvania, Washington, Illinois, and Ohio. SAT and achievement test scores were available for California and New York. Results indicated that New York and Pennsylvania students in academic, general, and vocational tracks received at least one more year of academic coursework than did the other students. Students in the academic tracks generally completed two or more years of academic courses than general track students, who completed one more year than vocational students. The credits earned in English and social studies were similar in all states, but there were substantial differences for foreign languages, mathematics, and science. Tracking was associated with different course selections, as was whether students were college bound versus noncollege bound, though New York and Pennsylvania students spent more time in academic study--on the average about one and one-half years of coursework regardless of whether they were college bound or noncollege bound. New York and California SAT achievement test-takers did not earn comparable scores on their achievement tests, and it was found that differences in amount of coursework had an impact on achievement. Comments are made regarding tracking and increasing graduation requirements. (GDC)

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RAISING HIGH SCHOOL GRADUATION REQUIREMENTS: A LOOK AT THE ASSUMPTION AND THE EVIDENCE

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During the past three years, considerable public attention has been given to high school graduation requirements. Dozens of national studies have been completed, most of which have recommended upgrading academic training through the imposition of higher graduation requirements. The most notable of these reports was the Nation at Risk, completed by the National Commission on Excellence in Education. This group recommended that high school students be required to complete four years of English, three years of social studies, three years of mathematics, three years of science, one half year of computer science, and for the college bound, two years of foreign language. Even before the final reports were issued, however, many states were in the throws of task forces, reports, recommendations, etc. As a result, to date over 40 states have changed their high school graduation requirements, in some cases establishing state-level requirements for the first time.

Policymakers assumed that increasing graduation requirements would ensure that students would spend more time studying basic academic subjects and thereby raise their level of performance. While the assumption appears perfectly reasonable, the National Commission's report, and many others as well, offered little evidence to support the assumed linkage between amount of coursework and achievement. For the most part, policymakers pushed their reforms ahead undaunted by the lack of empirical basis for their recommendations.

Nevertheless, data sets which offer the opportunity to examine the assumptions behind the new policies do exist. Two of these are the High School and Beyond Survey and SAT records. These two data sets were used in a study of Course Taking, Achievement, and Curricular Policy, which was recently completed at Northwestern University and which is the subject of this paper.

This study was guided by four general questions:

1. Were there differences among states in the amount of coursework taken by high school students?

2. Were there differences across states in achievement?

3. What is the relationship betweeen course taking and achievement?

4. What conclusions and implications for curricular policy can we draw from the findings?

High School and Beyond and SAT data each offer the advantage that the same questions and tests were used in all states and thus it is possible to make state-by-state comparisons. State-level analysis is appropriate since states have substantial responsibility for funding public education.

•High School and Beyond is a longitudinal study sponsored by the National Center for Education Statistics and carried out by NORC. Data on coursework taken during the last three years in high school were obtained from the base year (1980) survey for six states that had samples large enough to produce reliable state-level estimates. These were New York,

ABSTRACT

This paper summarizes an analysis of course taking patterns and achievement among 1980 seniors in New York, Pennsylvania, Ohio, Illinois, Washington, and California and 1982 seniors in New York and California. Both High School and Beyond and College Entrance Examination Board data indicated considerable variation across states in the amount of academic coursework completed, with New York and Pennsylvania students obtaining the most. After controlling for aptitude differences, performance on the CEEB achievement tests in American History, French, Math 2, and Chemistry was found to be positively associated with coursework in social studies, foreign language, mathematics and physical science. Results also revealed the importance of high school track as a determinant of coursework and suggested that efforts to increase academic coursework should lead to higher performance.

Pennsylvania, Illinois, Ohio, Washington, and California. Sample sizes ranged from 1,500 in Ohio to about 2,400 in California.

College Board data consisted of the records for all 1982 seniors from New York and California who took an SAT test. The information included verbal and math aptitude scores, achievement scores, and responses to a student descriptive questionnaire. There were 146,000 student records for New York and 110,000 for California.

Turning to the results, Table 1 shows the mean years of academic coursework across six states and broken down by track. The numbers represent the mean years of academic coursework during the last three years of high school. A difference of .1 means a difference of about 18 course periods of instruction. New York and Pennsylvania academic students received at least one year-long course more than their counterparts in the other states. The same can be said of general and vocational track students.

Track differences also are clear. On the average, academic students completed 2 to 2 and 1/2 year-long courses more than general students, and general students (except in Washington) studied the equivalent of one year-long course more than vocational students. It is important to recognize that general and vocational students may have as much or more coursework as academic students--but not in the academic subjects.

In Table 2, the six states are compared on mean years of coursework in seven academic subjects. The amount of coursework in English and social studies does not vary much by state and track. However, for foreign language, math, and science, you can see substantial differences. Again, New York and Pennsylvania students obtained the most coursework in each subject, with the exception of foreign language where New York alone was the highest. Track differences also are clear. An analysis of variance revealed that differences across states and tracks in mean years of English, math and science were significant.

We cannot readily assume that all academic students are college bound or that no general and vocational students attend college. Therefore, Table 3 compares the mean years of coursework taken by students who took a college entrance exam and those who did not. New York and Pennsylvania students, both the college and non-college bound, completed more academic coursework than students in the other four states. One exception is foreign language, for which New York and California students had the highest averages. Among the college bound, Washington students had the least coursework in English and Math, and Illinois college bound had the least preparation in social studies, foreign language, and science. As we saw in Table 2, discrepancies were greatest between college bound and non-college bound in foreign languages, math, and science. Compared to the college bound, the non-college bound took 1/2 to 1 year less of foreign language and 2/3 to 3/4 years less of math and science.

Table 1

Mean Total Academic Course Taking During Grades 10-12, Reported by 1980 Seniors, by Track and State

	NY	PA	IL	OH	CA	WA
Academic	12.9	12.6	11.1	11.5	11.3	11.5
General	10.5	10.3	9.0	9.3	8.9	8.8
Vocational	9.1	9.2	7.9	7.9	7.9	8.5

Includes English/Literature, history/social studies, French, German, Spanish, mathematics, and science.

Source: High School and Beyond data files for states indicated

Table 2

Mean Years of Academic Coursework During Grades 10-12, Reported by 1980 Seniors by Track and State

	NY	PA	IL	OH	CA	WA
English/Lit.						
Academic	3.1	3.1	3.1	3.1	2.9	2.9
General	3.1	3.1	3.0	2.9	2.7	2.7
Vocational	3.0	3.0	2.8	2.7	2.5	2.7
History/Soc. Stud.						
Academic	2.8	2.8	2.1	2.6	2.4	2.4
General	2.6	2.8	2.1	2.6	2.3	2.4
Vocational	2.6	2.6	1.0	2.2	2.1	2.4
Foreign Lang.						
Academic	1.9	1.7	1.4	1.4	1.6	1.6
General	1.0	.6	.8	.7	.9	.7
Vocational	.6	.4	.5	.4	.6	.6
Mathematics						
Academic	2.7	2.7	2.5	2.4	2.4	2.5
General	2.0	2.1	1.7	1.7	1.7	1.6
Vocational	1.6	1.8	1.5	1.6	1.5	1.5
Science						
Academic	2.5	2.5	2.1	2.1	2.0	2.1
General	1.8	1.7	1.4	1.3	1.3	1.5
Vocational	1.3	1.4	1.2	1.1	1.2	1.3

Sum of French, German, and Spanish.

Source: High School and Beyond data files for states indicated.

Table 3

Mean Years of Coursework, During Grades 10-12, Reported by 1980 Seniors, by College Entrance Exam, and by State

	NY	PA	IL	OH	CA	WA
English/Lit.						
All	3.1	3.1	2.9	2.9	2.8	2.7
SAT and/or ACT	3.1	3.1	3.0	3.1	2.9	2.8
None	3.0	3.0	2.8	2.7	2.8	2.7
History/Soc. Stud.						
All	2.7	2.7	2.1	2.5	2.3	2.4
SAT and/or ACT	2.7	2.7	2.1	2.6	2.4	2.4
None	2.6	2.7	2.0	2.3	2.3	2.4
Foreign Lang.						
All	1.3	1.0	1.0	.9	1.1	1.0
SAT and/or ACT	1.6	1.5	1.2	1.3	1.6	1.3
None	.6	.5	.5	.4	.7	.8
Mathematics						
All	2.3	2.3	1.9	2.0	1.9	1.8
SAT and/or ACT	2.5	2.6	2.2	2.3	2.3	2.1
None	1.7	1.9	1.4	1.5	1.7	1.6
Science						
All	2.1	1.9	1.6	1.6	1.6	1.6
SAT and/or ACT	2.3	2.3	1.8	1.9	1.9	1.9
None	1.5	1.5	1.2	1.2	1.3	1.5

Source: High School and Beyond data files for states indicated.

Besides looking at the years of coursework in each subject, it was also possible to examine the percentage of students who reported taking advanced mathematics--algebra, geometry, trigonometry, and calculus. A larger proportion of New York students in all tracks reported taking an advanced mathematics course (no table included). It is interesting that, while Pennsylvania students completed about the same amount of math courseowrk as New York students, they did not have as much coursework in the advanced courses. Math coursework in Pennsylvania must be made up more of general mathematics, business mathematics, and so forth.

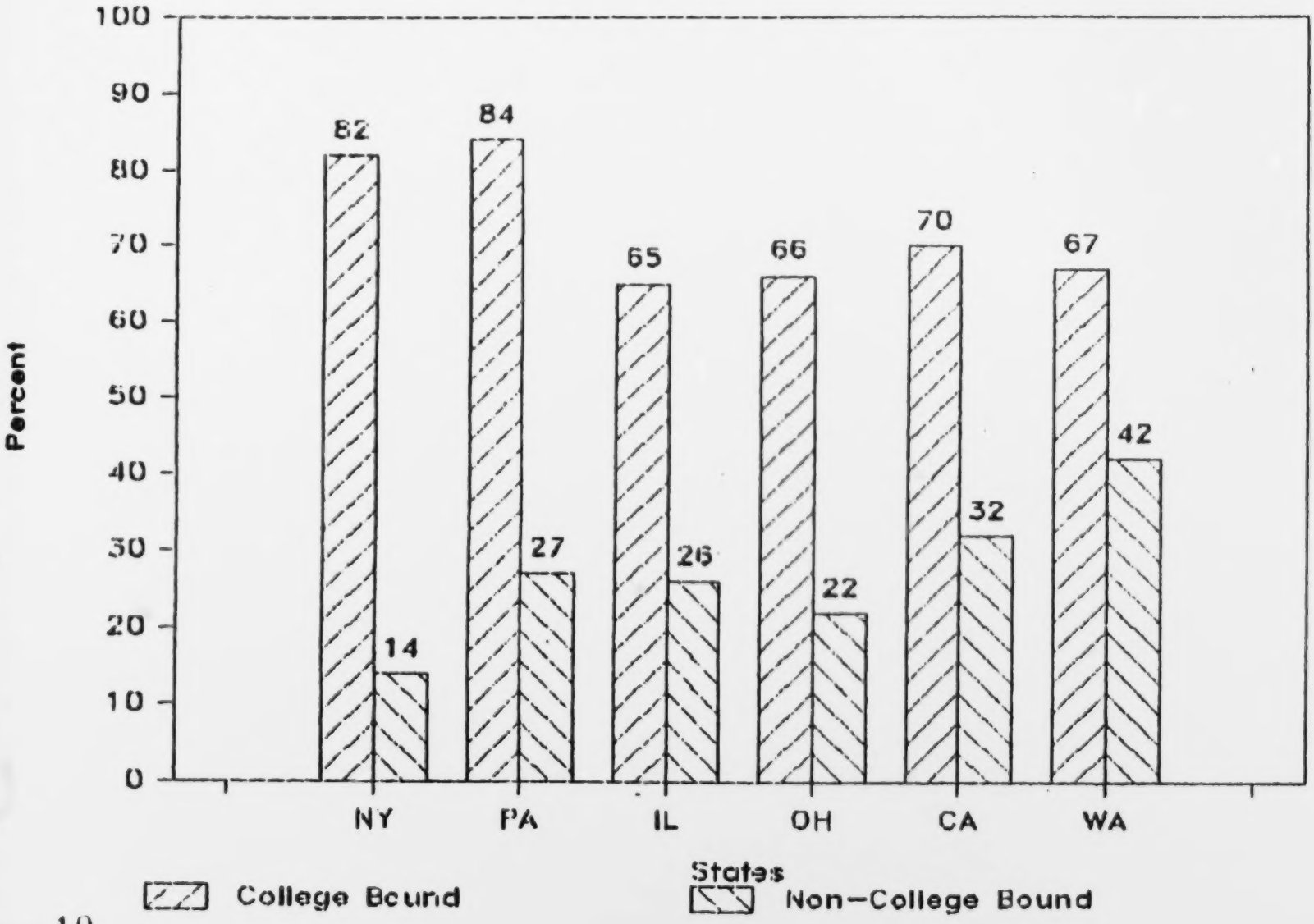
The next three figures (1-3) presents the same data on advanced mathematics, but this time broken down by whether or not the student took a college entrance exam. The most dramatic difference is between the non-college and college bound students. Comparing the states, these figures are consistent in that larger percentages of New York and Pennsylvania college bound students reported taking the advanced mathematics courses.

The second question guiding the study was whether the states varied in level of student achievement. We looked at the High School and Beyond test scores in mathematics, vocabulary, and reading. There were only small differences in overall mean scores across the six states, and even when scores were broken down by track, comparisons across states showed little variation. Because these tests covered broad intellectual skills rather than specific course content, we decided to use the SAT achievement tests to examine differences across states and especially to look at the relationship between achievement and time spent in coursework.

The advantage of the SAT achievement tests is that they are developed to cover specific course content found in most high school curricula and therefore provide a more tailored measure of secondary level achievement. In addition, students supplied information on the Student Descriptive Questionnaire about the number of years they had spent studying six different subjects. The combination of coursework and achievement data then made it possible to examine the relationship between coursework and achievement.

Using NCES estimates of the graduating class of 1982, the College Board determined that 36% of California students compared to 59% of New York seniors completed the SATs. Despite differences in the proportion of test takers, however, the distribution of verbal aptitude and mathematics aptitude was almost identical in the two states.

This was not the case for the achievement test takers, however. Because of the University of California requirement that applicants provide three achievement test scores, considerably higher proportion of California students compared to New York students take the achievement tests. Figure 4 illustrates the differences in the selection process between the two states. Proportionately more California students of lower aptitude elected to take a College Board achievement test. Obviously this makes comparison of the two states quite difficult because we do not have representative samples of seniors and in fact we have evidence that aptitude level was not uniformly distributed across the two populations. The New York group was more selective in terms of aptitude level. Controlling for differences in selectivity was a major challenge to these analyses.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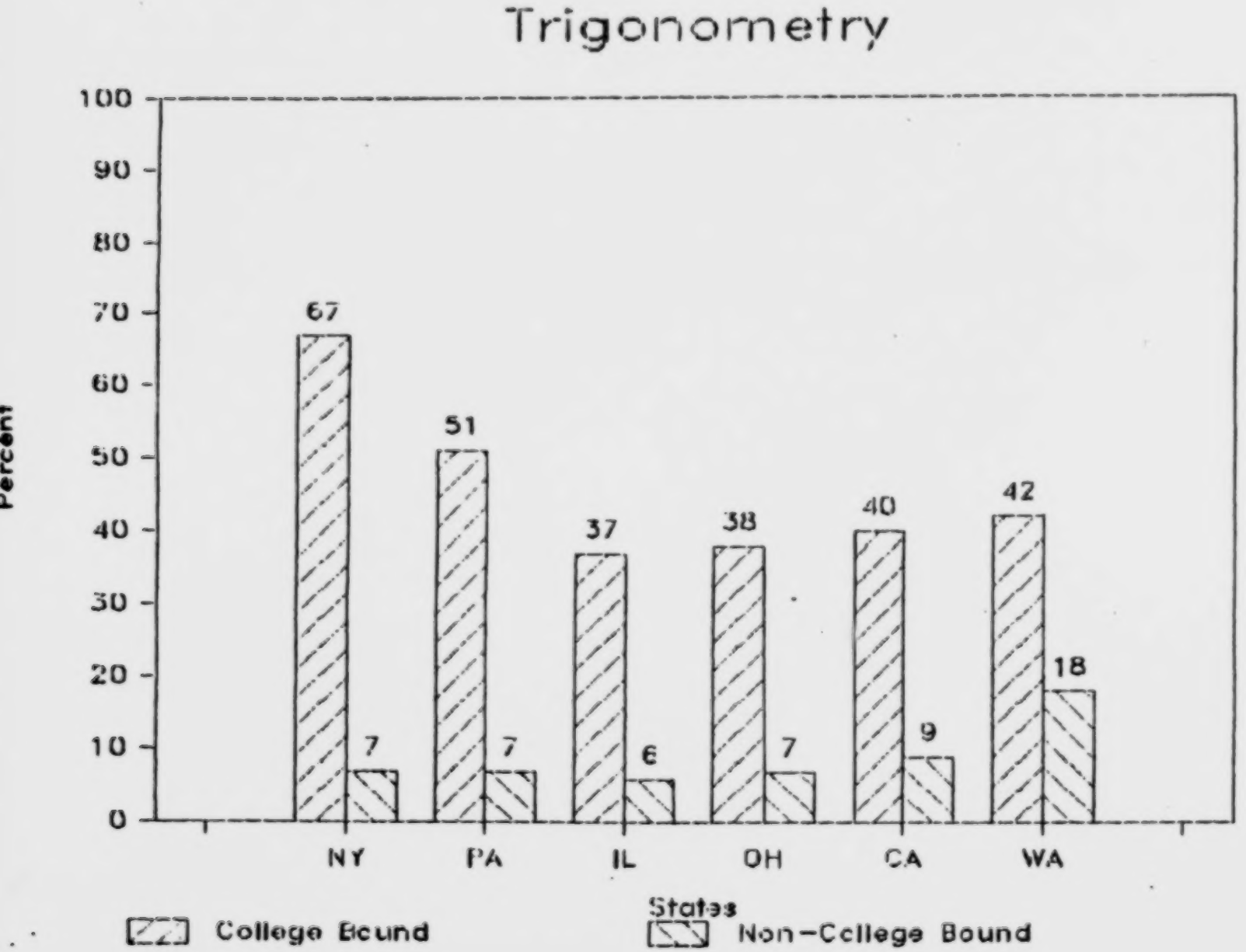
States
College Bound
Non-College Bound

Figure 1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Non-College Bound

Figure 2

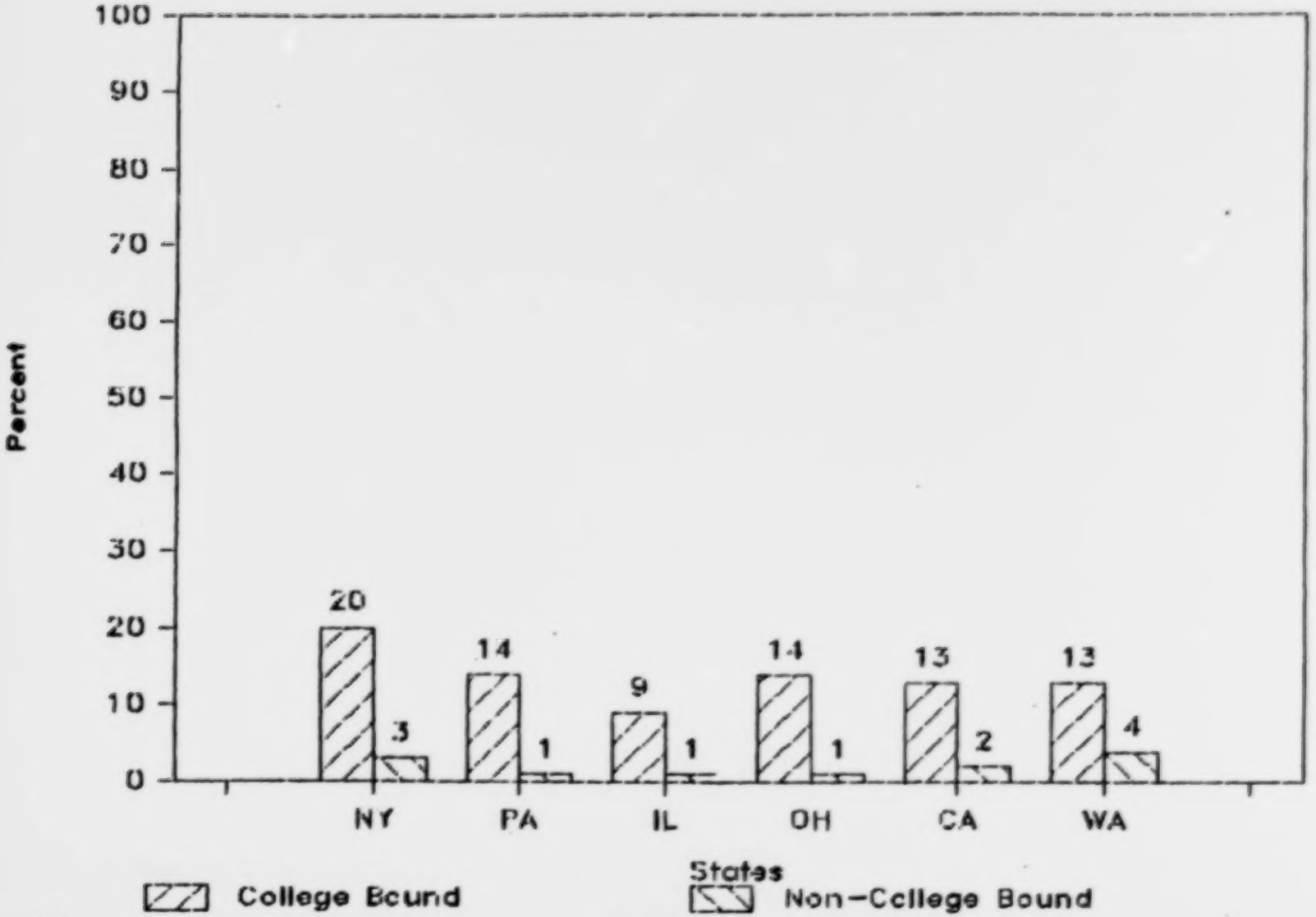
Calculus
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Figure 3

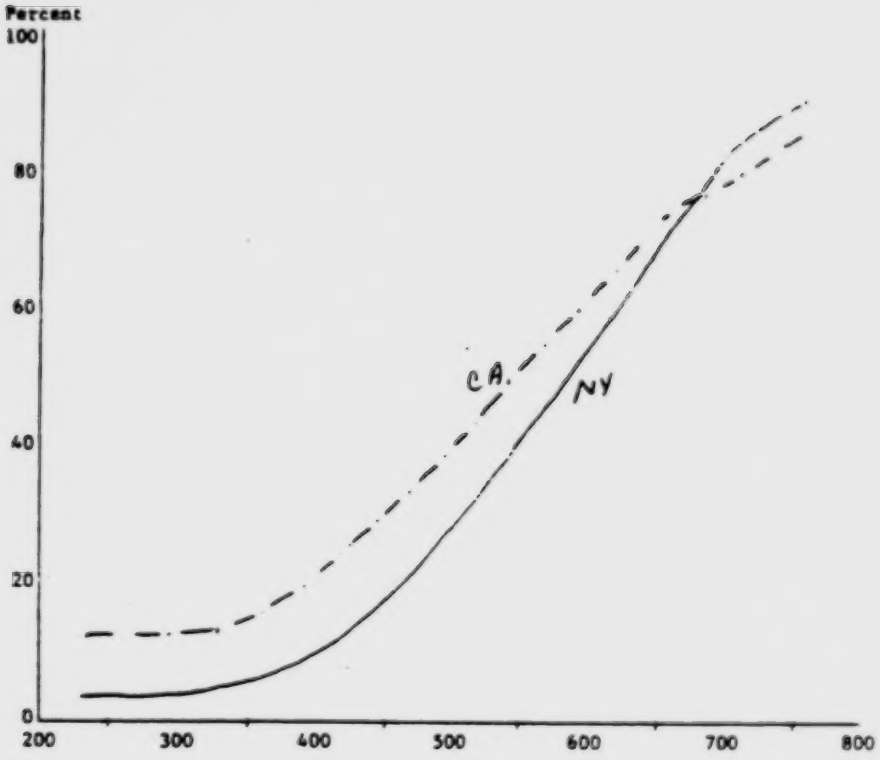

Fig. 4 Achievement test takers[1] as percent of aptitude test takers at each Verbal Aptitude score interval.

[1]Took at least one Achievement Test.

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The amount of coursework taken in six different subjects by New York and California SAT takers is shown in Table 4. This table covers coursework over four years of high school. Among achievement test takers, the largest differences in coursework were in social studies, foreign language, math, and physical science. These findings reinforce the High School and Beyond results, again showing that New York students spend more time in academic coursework than do California students.

Whether more coursework translates into higher achievement was the third question driving the study. Four achievement test populations were selected for analysis. These were American History, French, Math 2, and Chemistry. The reasons for selecting these four tests had to do with the within and between state differences in coursework. Coursework in English and biological science did not vary much within each state or across states, and so they offered little opportunity for assessing differences in quantity of coursework. There were large differences between states in social studies coursework, differences within states in math instruction, and both within and across state differences in foreign language study and physical science.

The next table (Table 5) shows that a much larger, less select group of California students than New York students took the American History test and they received lower scores. The same is true of French and Math 2. For the Chemistry test, however, the pattern is somewhat different. A much smaller, select group of California students completed the Chemistry test but they received overall lower scores on the test. At this point, then we have evidence that the New York students obtained higher mean scores, but they also had higher mean aptitude scores, and therefore we can't tell whether the New York students earned higher scores as a result of more coursework or due to selectivity factors.

To begin to disentangle the effects of selection from the effects of coursework, students in each test population were divided into nine strata according to their scores on the verbal and mathematics aptitude tests. The nine strata represented the combination of high, moderate and low verbal and math aptitude scores, and they are shown in Fig. 5. One stratum eventually was dropped because it contained so few cases. Within these strata plots were constructed of mean achivement by mean years of coursework for each state, and regression analyses were conducted to determine the effects of years of coursework on achievement. This allowed us to see if the relationship between coursework was consistent across aptitude groups and to make comparisons across states for students of comparable aptitude.

The plots of mean years of coursework by mean achievement level for each state and each aptitude group are shown in Figures 6-9. New York students spent more time studying social studies and earned higher scores in American History, and this was true for all aptitude groups. The same can be said for foreign language and French. The pattern was different for math, however. The plot shows that students of comparable aptitude levels in both states spent about the same amount of time in math coursework and earned very similar scores on the Math 2 test. For Chemistry, again, New York students reported spending more time in the study of physical science and earned higher scores.

Table 4

Mean Years of Coursework During Grade 9-12,
Reported by Scholastic Aptitude Test Takers, 1982
New York and California

	NY	CA	Diff
English			
All	3.99	3.96	.03
Apt. Test Only	3.94	3.87	.07
Apt. Test + Ach. Test	4.02	4.03	-.01
Social Studies			
All	3.57	3.21	.36
Apt. Test Only	3.51	3.17	.34
Apt. Test + Ach. Test	3.67	3.25	.42
Foreign Language			
All	2.50	2.30	.20
Apt. Test Only	2.26	2.09	.17
Apt. Test + Ach. Test	3.27	2.79	.48
Mathematics			
All	3.54	3.36	.18
Apt. Test Only	3.36	3.19	.17
Apt. Test + Ach. Test	3.96	3.70	.26
Biological Science			
All	1.32	1.33	-.01
Apt. Test Only	1.28	1.31	-.03
Apt. Test + Ach. Test	1.41	1.36	.05
Physical Science			
All	1.94	1.36	.58
Apt. Test Only	1.81	1.20	.61
Apt. Test + Ach. Test	2.41	1.70	.71

Students who took at least one Achievement Test.

Source: College Board Admissions Testing Program data, 1982.

Table 5

Aptitude and Achievement Test Scores,
New York and California SAT Takers, 1982

	% of Apt Test Takers	Verb Apt	Math Apt	Ach Score
Am Hist				
NY	4	540	547	547
CA	21	491	553	489
French				
NY	2	560	564	564
CA	3	513	556	526
Math II				
NY	2	569	658	670
CA	6	533	638	655
Chemistry				
NY	6	545	550	604
CA	1	617	649	590

Verbal-Math Aptitude Strata

LO-LO	LO-MD	LO-HI
MD-LO	MD-MD	MD-HI
HI-LO	HI-MD	HI-HI

Figure 5

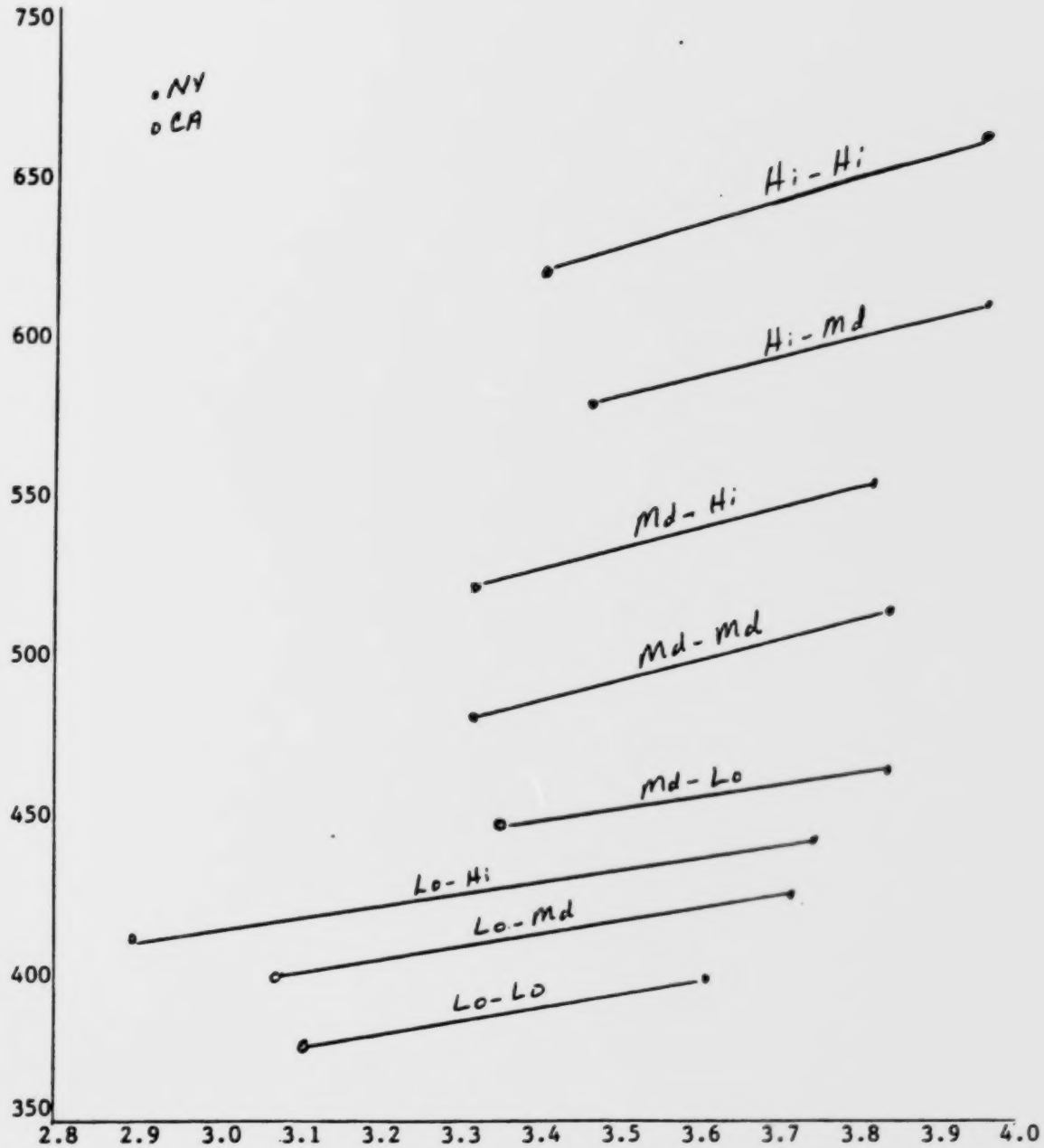

Figure 6 American History achievement score by years of social studies by 8 aptitude categories.

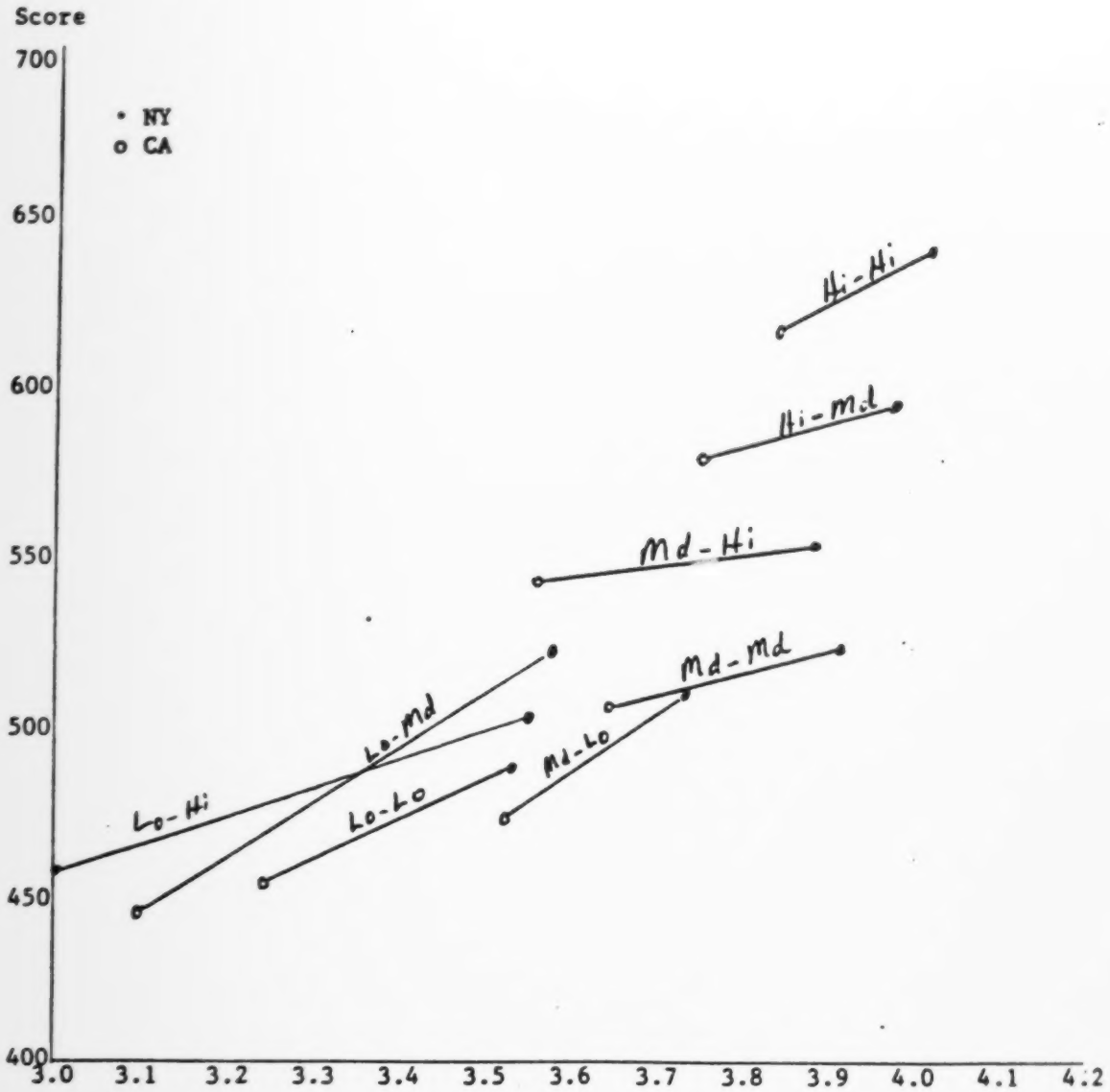

Figure 7 French achievement test scores by years of Foreign Language for 8 aptitude categories.

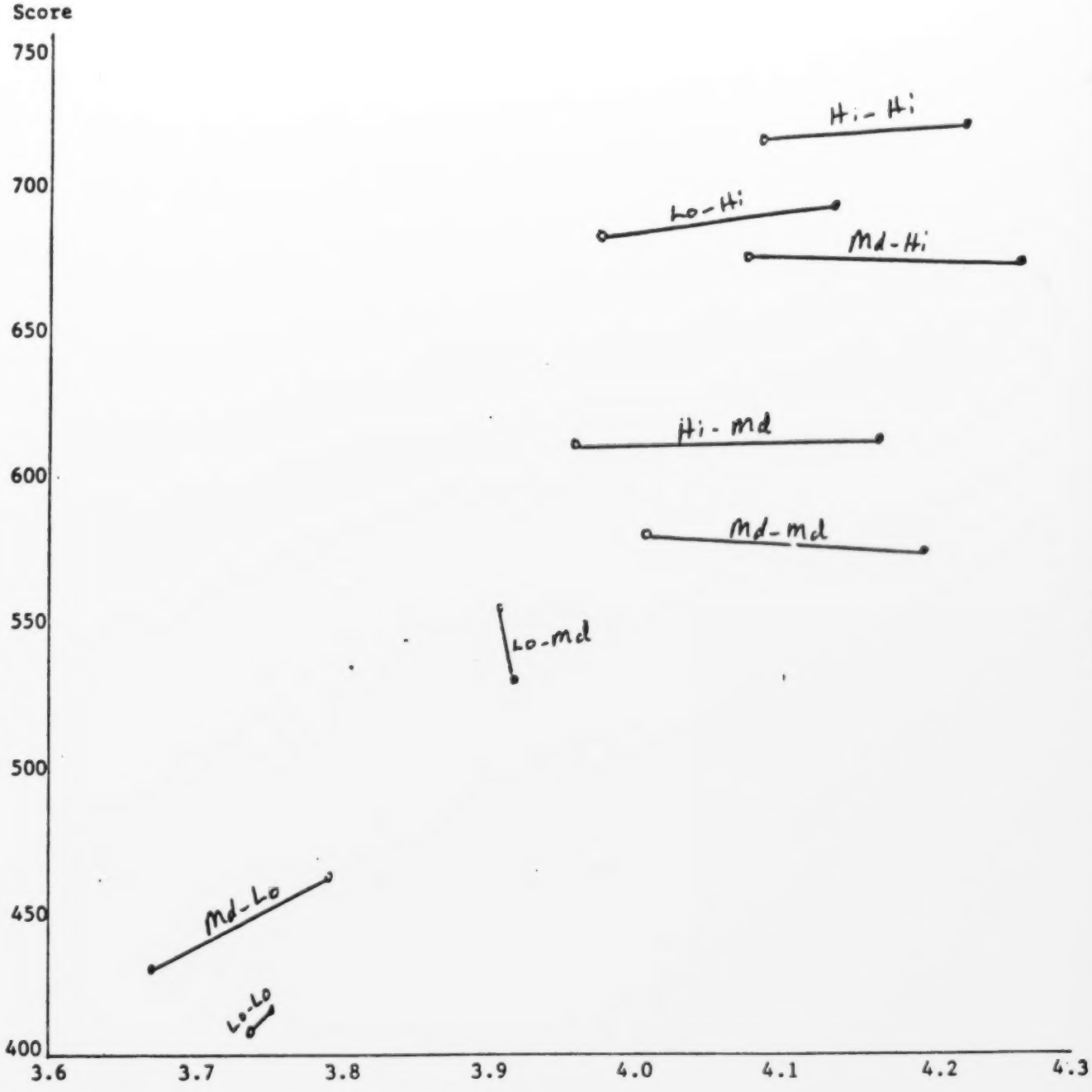

Figure 8 Math 2 scores by years of math.

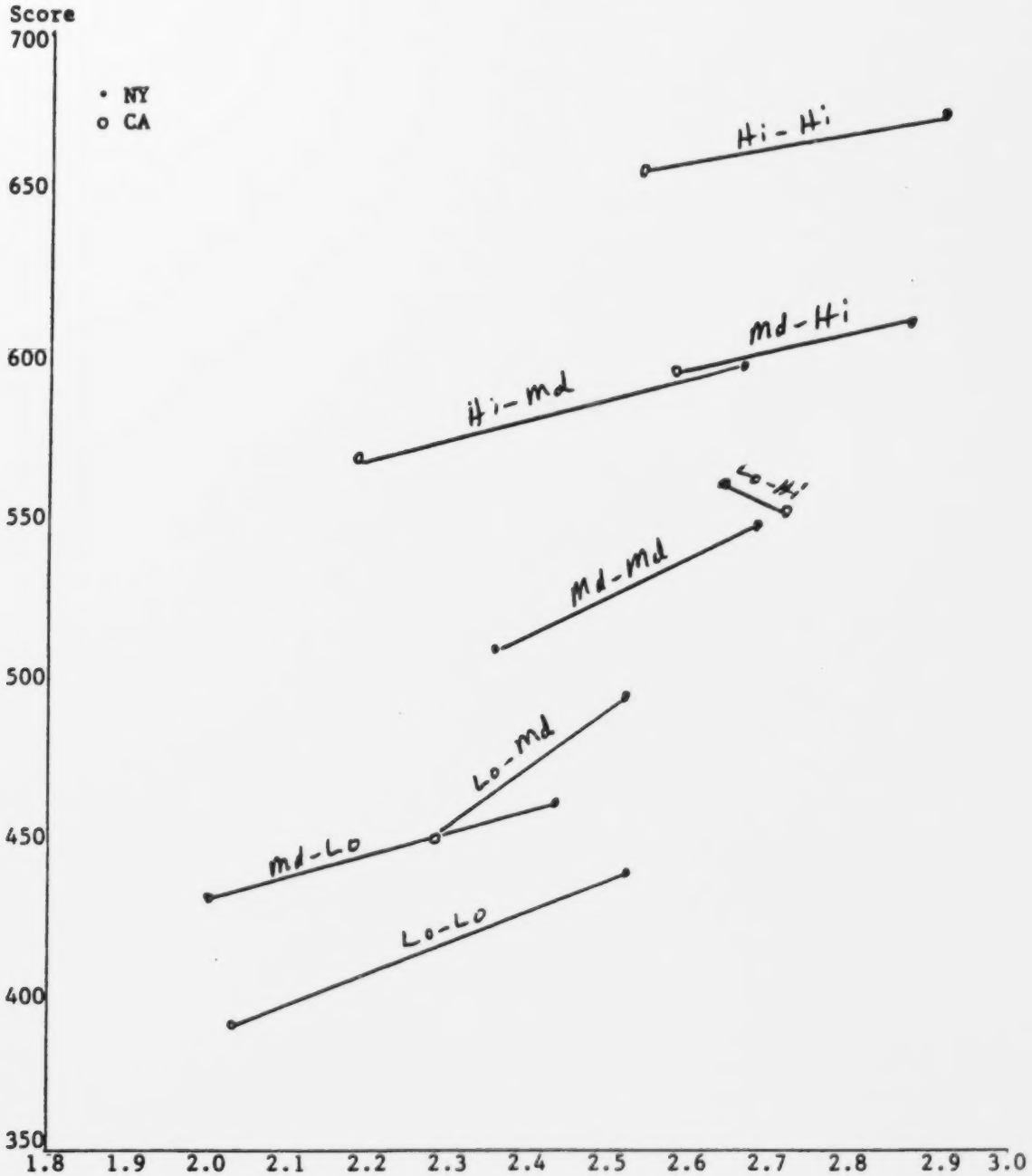

Figure 9 Chemistry scores by years of physical science.

The final table shows the overall regression coefficients for years of study on achievement. These were calculated within each stratum and adjusted for measurement error. These coefficients varied somewhat by aptitude level but not in a consistent manner, so that we think they are reasonable estimates for all achievement test takers in each state of the effects of a year of coursework in each subject. Notice the difference between the social studies coefficients between New York and California. They reveal that New York students not only had higher achievement scores as a result of more time spent in coursework, but each unit of coursework, in this case a year, appeared to have a stronger impact on achievement. The increment in learning and achievement was greater in New York for each year of social science study.

To sum up the data, then, we saw that there were consistent differences in the exposure to coursework first across the six states and finally between New York and California. New York and Pennsylvania students, regardless of their high school track and regardless of whether they were college bound or non-college bound spent more time in academic study--on the average about one and one half year of coursework. Track also was a potent determiner of exposure to academic coursework. New York and California SAT achievement test takers did not earn comparable scores on their achnievement tests, and once we controlled for aptitude, we found that differences in amount of coursework had an impact on achievement. This brings us to the final question of the study, which is what are the implications of the findings for curricular policy.

These data suggest that the evidence tends to support the assumptions made by policymakers. Among SAT achievement test takers, higher test scores were associated with spending more time in the relevant coursework. While this is not a probability sample, we found that the relationship between coursework and achievement held across most aptitude levels. Furthermore, the findings of this study are consistent with those of three others which also have examined the effects of coursework on achievement for secondary students. One study was based on the National Longitudinal Study of the Class of 1972 (Schmidt), another on the ETS study of Academic Growth and Prediction (Alexander and Pallas), and the third was based on national High School and Beyond data (Walberg).

An additional question raised by these data is the issue of educational opportunity. New York and Pennsylvania, especially the college bound have the advantage of more schooling than students in the other four states. New York students come to the SAT test much better prepared in physical science, social science, math, and foreign language than do California students. Students in some states have greater opportunity than students in other states.

Furthermore, these findings call attention to tracking. Academic students completed about 2 and 1/2 years more coursework than general students and about 3 and 1/2 year long courses more than vocational students. We know from other studies that the ways that students get tracked is not always clear, and often students lack information or realistic guidance about the courses they choose to take in high school. Since track is a potent determinant of coursework a student is exposed to, and since coursework affects performance, at a minimum students should have

Table 6

Overall Regression Coefficients of Years of Coursework on Achievement

	NY	CA
Years of Social Science on American History Scores	50	12
Years of Foreign Language on French Scores	60	60
Years of Math on Math II Scores	15	12
Years of Physical Science on Chemistry Scores	25	25

adequate information. Also, policies that encourage students to follow one track or another need to be carefully thought through.

Increasing the amount of coursework can be accomplished through four different means, and possibly more. First, graduation requirements can be raised, and this is what has happened in 42 states. Secondly, states could adopt a regents type system, such as the one in New York. This system not only prescribes the kinds and amounts of coursework students must take but also requires them to pass a test on the content. The statewide testing probably anchors the coursework in such a way that course content is quite uniform across the state. Third, policies might be adopted that encourage more students to follow an academic track, such as monetary incentives to school districts for enrollments in math and science or other academic subjects. Finally, changes in university admissions requirements can have strong impact on course taking at the high school level.

The move toward tougher requirements is not without drawbacks. Increasing the graduation requriements means that teachers may have to be hired or trained for new assignments. Curriculum development would be needed for the additional year of math or science or whatever subject. Spending more time in math will not have any effect if the extra time is not used in meaningful ways. Also, some people worry about the possibility that the drop out rate will increase as standards are raised. Others point to the difficulties that higher graduation requriements will pose for the disadvantaged. Finally, there is the cost of keeping students in class for longer periods of time.

In conclusion, the evidence from this study generally support the assumptions behind current policy initiatives taking place at the state level. Empirical support, however, is no substitute for thoughtful implementation.

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